

Self-Regulated Learning in Generative AI-Assisted Academic Writing: A Systematic Review of ESL/EFL University Students

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ABSTRACT

The growing use of generative AI writing assistants, such as ChatGPT, in ESL/EFL academic contexts has sparked debate about their influence on self-regulated learning (SRL). This systematic review examines 41 empirical studies published between 2021 and March 2026 to evaluate how university students engage with AI tools in relation to SRL. Guided by PRISMA 2020 standards, the review synthesises quantitative, qualitative, and mixed methods research through narrative analysis, drawing on Zimmerman's (2000) three phase SRL model and metacognitive regulation theory. Three central patterns emerge. First, SRL phases are unevenly addressed: the performance phase dominates (92.7% of studies), while forethought (58.5%) and self-reflection (51.2%) receive less attention, suggesting an incomplete regulatory cycle. Second, AI demonstrates a dual role in metacognitive regulation, facilitating monitoring, evaluation, and revision (68.3%), yet also contributing to cognitive offloading and reduced learner agency (14.6%), with 17.1% of studies reporting mixed outcomes. Third, pedagogical design is critical: structured approaches that integrate AI literacy, guided feedback, and teacher mediation consistently enhance SRL, whereas unguided use yields weaker results. The evidence base remains limited by its concentration in Asian contexts (73.2%), reliance on self-report data, and absence of longitudinal designs, restricting claims about sustained competence. Overall, the review concludes that generative AI can strengthen self-regulated academic writing when embedded in intentional pedagogical frameworks that activate all SRL phases; without such alignment, AI may improve immediate performance but hinder the development of lasting regulatory skills.

Keywords: self-regulated learning, generative AI, academic writing, ESL/EFL, metacognitive regulation, systematic review.

1. INTRODUCTION

Academic writing is a cornerstone of higher education, particularly for English as a Second Language (ESL) / English as a Foreign Language (EFL) university students who must navigate complex linguistic, cognitive, and disciplinary demands to succeed in scholarly communication. Effective writing not only demonstrates mastery of content but also cultivates critical thinking, metacognition, and disciplinary identity (Chauhan, 2022; Rahnuma, 2025). However, for many ESL learners, academic writing remains a persistent challenge due to limited vocabulary, difficulties with coherence, and insufficient exposure to genre conventions (Chung & Wan, 2025). These challenges highlight the importance of self-regulated learning (SRL), which enables learners to plan, monitor, and reflect on their writing processes in a strategic and goal-directed manner (Zimmerman, 2000; Jin et al., 2023). The terms ESL and EFL are used interchangeably in this study, reflecting their frequent overlap in the literature.

The emergence of generative AI writing assistants, such as ChatGPT, has introduced both opportunities and tensions in this landscape. On one hand, these tools can provide immediate feedback, scaffold idea generation, and support revision, thereby enhancing learner autonomy and access to academic discourse (Nikolopoulou, 2024; Kanont et al., 2024). On the other hand, concerns persist regarding over-reliance, diminished cognitive engagement, and the potential externalisation of metacognitive processes, particularly for ESL learners who may depend more heavily on such tools due to linguistic constraints (Lan & Zhou, 2025). While recent systematic reviews highlight AI's potential to support SRL processes, particularly in the performance phase, they also reveal deeper theoretical and methodological inconsistencies in how SRL is conceptualised and studied in AI-mediated contexts (de Mooij et al., 2025; Molenaar et al., 2023). Despite the rapid expansion of research in this area, three critical gaps remain. First, existing studies demonstrate inconsistent integration of SRL theory, often privileging

observable behaviours in the performance phase while neglecting the forethought and self-reflection processes essential for sustained learning (Sinkkonen & Tapani, 2024; Banihashem et al., 2025; Zhang et al., 2025). Second, the literature is dominated by short-term, cross-sectional designs that emphasise immediate improvements in writing performance rather than the long-term development of self-regulatory competence, raising concerns about a performance–competence divide (Lan & Zhou, 2025; Xu et al., 2026; Nikolopoulou, 2024; Tekir, 2026). Third, limited systematic evidence exists on pedagogical interventions that explicitly integrate generative AI within SRL frameworks, leaving unclear how instructional design shapes the relationship between AI use and self-regulated learning outcomes (EL Hosayny et al., 2025; Mazari, 2025; Stofiana et al., 2025; Banihashem et al., 2025). Additionally, the existing body of research is largely concentrated in Global North contexts, with limited representation from African settings, particularly Sub-Saharan Africa, raising concerns about the contextual relevance and transferability of findings. Addressing these gaps requires a theoretically grounded and analytically rigorous synthesis of existing research.

This systematic review, therefore, aims to critically examine how generative AI writing assistants influence self-regulated learning in ESL/EFL university students' academic writing. By situating AI use within established SRL frameworks and evaluating both its affordances and limitations, this study provides a comprehensive understanding of how these tools can be integrated in ways that strengthen, rather than undermine, learners' capacity for self-regulated academic writing.

The main objective of this study is to systematically examine how generative AI writing assistants influence self-regulated learning (SRL) in ESL/EFL university students' academic writing.

The specific objectives are:

1. To synthesise the representation of self-regulated learning strategies across Zimmerman's three-phase model (forethought, performance, and self-reflection) in studies of ESL/EFL university students using generative AI writing assistants.
2. To examine the extent to which generative AI writing assistants support or hinder metacognitive regulation, particularly in terms of monitoring, evaluation, and reflection in academic writing tasks.
3. To evaluate pedagogical strategies that have been empirically tested in studies integrating generative AI writing assistants, and to assess their outcomes in supporting ESL/EFL students' self-regulated learning.

1.2 Problem Statement

Academic writing poses significant challenges for ESL/EFL university students, who must navigate linguistic limitations, disciplinary conventions, and higher-order cognitive demands (Chung & Wan, 2025; Chauhan, 2022). Although self-regulated learning (SRL) provides a robust framework for understanding how learners plan, monitor, and reflect on their writing processes (Zimmerman, 2000; Jin et al., 2023), its application in AI-mediated academic writing remains uneven and theoretically underdeveloped, partly because existing SRL models have not been systematically adapted to account for human-AI interaction in learning contexts. The increasing integration of generative AI writing assistants, such as ChatGPT, has introduced new possibilities for supporting writing through real-time feedback, idea generation, and revision scaffolding (Nikolopoulou, 2024; Kanont et al., 2024). However, these affordances are accompanied by unresolved concerns, including cognitive dependency, reduced learner agency, and the potential externalisation of metacognitive regulation, that have been documented in recent critiques (Kanont et al., 2024; Lan & Zhou, 2025; Nikolopoulou, 2024).

Despite the rapid expansion of research in this area, current evidence remains fragmented and insufficient to support clear theoretical or pedagogical conclusions. First, SRL is inconsistently operationalised as studies focus on observable behaviours during the performance phase, systematically neglecting the forethought and self-reflection processes essential for sustained learning (Lan & Zhou, 2025; Molenaar et al., 2023). Second, the literature is dominated by short-term, cross-sectional designs that prioritise immediate performance gains over the longitudinal development of self-regulatory competence, raising concerns about a performance–competence divide (de Mooij et al., 2025; Xu et al., 2026). Third, generative AI is frequently treated as an isolated technological variable, with limited attention to the pedagogical conditions that shape its integration, resulting in an under-theorised understanding of how instructional design mediates SRL outcomes (Jin et al., 2023). Compounding these limitations, existing findings are often contradictory, with some studies reporting enhanced metacognitive engagement and others documenting diminished learner agency in AI-supported writing contexts (Lan & Zhou, 2025; Tekir, 2026).

As a result, it remains unclear whether generative AI functions as a scaffold that enhances self-regulated learning or as a substitute that undermines the internalisation of metacognitive processes. This lack of clarity constrains educators' ability to make informed decisions about the effective integration of AI in ESL/EFL academic writing contexts. Therefore, a systematic and theoretically grounded synthesis is required. This review

examines how generative AI writing assistants influence SRL across the forethought, performance, and self-reflection phases, evaluates their impact on metacognitive regulation, and identifies the pedagogical conditions under which these tools support or hinder the development of self-regulated academic writing.

2. LITERATURE REVIEW

This section presents literature that was reviewed to inform the study.

2.1 Self-Regulated Learning (SRL) Framework

Drawing on Zimmerman's (2000) foundational work, as synthesised in recent meta-analyses (Xu et al., 2026; Banihashem et al., 2025), self-regulated learning (SRL) is widely recognised as a cyclical process through which learners actively manage cognition, motivation, and behaviour to achieve academic goals. However, its application in AI-assisted writing research remains selective and theoretically inconsistent (de Mooij et al., 2025). Most studies adopt Zimmerman's three-phase model, forethought, performance, and self-reflection, as the dominant framework (Mäkipää & Tsagari, 2026; Xu et al., 2026). Despite this widespread adoption, the model is rarely applied holistically. Instead, research disproportionately emphasises observable behaviours within the performance phase, while underrepresenting the cognitively and motivationally complex processes associated with forethought and self-reflection (Lan & Zhou, 2025; Molenaar et al., 2023).

The forethought phase, encompassing goal setting, strategic planning, and self-efficacy beliefs (Zimmerman, 2000), is particularly underrepresented. While Tekir (2026) found that selective AI users demonstrated intentional goal setting, most studies treat forethought as a static precursor rather than a dynamic process that interacts with AI use. Similarly, self-efficacy, a critical predictor of SRL engagement, is rarely examined in relation to AI writing assistance, despite evidence that over-reliance on AI may erode learners' confidence in their own writing abilities (Xu et al., 2026). The performance phase, particularly strategy use and monitoring, is heavily foregrounded in studies examining interactions with AI tools (EL Hosayny et al., 2025). Furthermore, while the self-reflection phase is theoretically recognised as essential for sustaining SRL cycles (Torsani, 2025), it is rarely examined beyond immediate task outcomes, with limited attention to its role in shaping future learning. This suggests that SRL is frequently invoked as a conceptual label rather than applied as a fully integrated analytical framework, limiting its explanatory power in AI-mediated contexts (de Mooij et al., 2025).

2.2 Metacognitive Regulation in AI-Assisted Writing

Metacognitive regulation is increasingly positioned as the key mechanism through which generative AI influences SRL; however, the literature reveals a fundamental tension between enhancement and externalisation. Metacognitive regulation, defined as the active control of cognitive processes through monitoring, evaluation, and reflection (Schraw & Dennison, 1994, as cited in Banihashem et al., 2025), is central to effective academic writing (Chauhan, 2022; Stofiana et al., 2025). In AI-assisted environments, this regulatory role extends to evaluating AI-generated outputs, fundamentally reshaping the nature of self-regulation (Lan & Zhou, 2025).

A dominant strand of research suggests that generative AI enhances metacognitive regulation by providing real-time feedback, iterative drafting support, and alternative linguistic formulations (Nguyen et al., 2024; Nikolopoulou, 2024). In this view, monitoring involves both tracking one's own progress and verifying AI outputs, while evaluation requires assessing the accuracy, relevance, and ethical implications of generated content (Tekir, 2026). Reflection is similarly framed as a process through which learners maintain authorial control and internalise feedback (Mazari, 2025).

However, an emerging body of research challenges this perspective, arguing that AI may externalise key regulatory processes. When tools assume functions such as error correction and idea generation, learners may engage less deeply in monitoring and evaluation, effectively outsourcing aspects of self-regulation (Kanont et al., 2024). This creates a paradox: AI appears to support metacognitive activity while potentially undermining its internalisation. Despite this tension, existing studies rarely distinguish between genuine metacognitive development and AI-supported task completion, leaving the impact of AI on SRL theoretically ambiguous and empirically under-validated (Lan & Zhou, 2025).

2.3 Generative AI in ESL/EFL Writing: Pedagogical Promise versus Cognitive Dependency

Research on generative AI writing assistants in ESL/EFL contexts converges on the view that these tools act as powerful mediating artefacts, yet diverges significantly in assessing their pedagogical value. Tools such as ChatGPT, Grammarly, and QuillBot etc are widely reported to reduce linguistic barriers by supporting grammar, vocabulary, and translation, thereby enabling learners to focus on higher-order writing processes (Tekir, 2026). Within Human-AI Shared Regulation frameworks, AI is conceptualised as a collaborative partner that scaffolds learning and reduces cognitive load (Nguyen et al., 2024).

However, this optimistic perspective is counterbalanced by evidence of unintended consequences. Studies indicate that while frequent AI use improves linguistic fluency, it may also reduce originality, weaken argumentation, and diminish authorial voice (Tekir, 2026). These findings suggest that AI may prioritise efficiency and product quality over deeper cognitive engagement with the writing process. Moreover, the assumption that AI functions as a metacognitive partner presupposes that learners possess sufficient regulatory competence to critically engage with AI outputs, an assumption that remains largely unexamined, particularly in relation to learners' foundational academic vocabulary knowledge (Chung & Wan, 2025; Rahnuma, 2025).

The literature reflects two competing assumptions, which are that AI supports higher-order learning through scaffolding and that it fosters dependency through cognitive offloading. What remains insufficiently explored is how contextual factors, such as task design, learner proficiency, and instructional guidance, shape these outcomes (Nikolopoulou, 2024).

2.4 Pedagogical Integration of Generative AI as a Critical Factor

While existing research acknowledges both the affordances and risks of generative AI, far less attention has been given to how these tools are pedagogically integrated, revealing a critical gap between technological capability and instructional design (Lan & Zhou, 2025). Emerging evidence suggests that the impact of AI on self-regulated learning is not inherent in the tools themselves but contingent on how they are embedded in structured learning environments. Studies that incorporate guided AI use, through scaffolded prompts, reflective activities, and explicit strategy instruction, report higher levels of metacognitive engagement and more deliberate use of SRL strategies. In contrast, unguided use is often associated with surface-level interaction and increased reliance on AI to complete tasks (Nikolopoulou, 2024).

This divergence highlights a key limitation in the literature that AI is frequently examined as an isolated variable, while its pedagogical orchestration remains under-theorised. Few studies explicitly align AI-supported activities with the phases of Zimmerman's SRL model, leaving unclear how instructional design can support the integrated development of forethought, performance, and self-reflection (Banihashem et al., 2025; de Mooij et al., 2025). As a result, current research offers limited guidance on designing AI-mediated learning environments that promote rather than undermine self-regulated learning. This gap underscores the need for a systematic synthesis that foregrounds pedagogy as a central factor in shaping AI-supported SRL outcomes.

2.5 Methodological and Theoretical Limitations as a

Fragmented Evidence Base

Despite the rapid growth of research on AI and SRL, the field remains methodologically and theoretically fragmented. A major limitation is the dominance of short-term, cross-sectional studies, which are insufficient for capturing the developmental nature of self-regulated learning (Banihashem et al., 2025; de Mooij et al., 2025; Xu et al., 2026). This raises concerns about whether observed improvements reflect genuine competence or temporary reliance on AI, contributing to a performance-competence divide (Lan & Zhou, 2025). Jin et al. (2023) further caution that without longitudinal designs, it remains unclear whether AI-supported SRL gains represent durable skill development or task-specific compliance that may dissipate once AI support is withdrawn.

Additionally, the literature relies heavily on descriptive approaches and self-report measures, with limited use of process-oriented methods, such as learning analytics (Nguyen et al., 2024). Many studies lack explicit theoretical grounding, and even when SRL is referenced, it is not consistently applied across all phases (Banihashem et al., 2025). Contextual imbalances further constrain the field, with research concentrated in specific regions and predominantly on higher-education writing tasks (Chung & Wan, 2025; Zhang et al., 2025). Furthermore, while writing has received disproportionate attention, other language skills essential for academic success, such as speaking, listening, and vocabulary development, remain critically underexplored in the AI-SRL literature (Kanont et al., 2024; Rahnuma, 2025).

Collectively, these limitations demonstrate that, despite the growing volume of research, the field remains insufficiently developed to support robust and generalisable conclusions.

2.6 Literature Synthesis and Gap Analysis

The literature reviewed reveals a fragmented and uneven understanding of how generative AI influences self-regulated learning in ESL/EFL academic writing. Existing studies disproportionately focus on the performance phase of SRL, while neglecting the forethought and self-reflection processes essential for sustained learning (Molenaar et al., 2023). With respect to the second research objective, examining how AI supports or hinders metacognitive regulation, the literature presents a divided picture. While studies confirm that AI can prompt monitoring and evaluation behaviours (EL Hosayny et al., 2025; Tekir, 2026), there is insufficient evidence to determine whether these behaviours represent genuine metacognitive development or task-specific compliance. Furthermore, the self-reflection phase remains critically

underexplored, with few studies examining how learners internalise AI feedback or transfer regulatory strategies to unaided writing tasks.

The pedagogical conditions under which AI is used remain underexamined, limiting insight into how instructional design mediates learning outcomes (Nikolopoulou, 2024). These limitations reinforce the three central gaps identified in the introduction: inconsistent theoretical integration of SRL, a predominance of short-term performance-focused research, and a lack of pedagogically grounded evidence. In response, this study systematically synthesises research on generative AI-assisted academic writing in ESL/EFL contexts by examining SRL across its three phases, evaluating the role of metacognitive regulation, and identifying pedagogical strategies and their reported outcomes. In doing so, it provides a more coherent and critically grounded understanding of how generative AI can support self-regulated learning in higher education.

3. METHODOLOGY

3.1 Research Design

This study employed a systematic literature review design guided by the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) 2020 framework to ensure transparency, methodological rigour, and reproducibility (Page et al., 2021). The PRISMA framework provides a structured procedure consisting of sequential phases that enhance the credibility and replicability of systematic reviews.

The present review synthesises empirical research on the role of generative AI writing assistants in shaping self-regulated learning (SRL) among ESL/EFL university students engaged in academic writing. A review protocol was developed before conducting the study to guide the search, screening, and analysis procedures; however, it was not formally registered, which is acknowledged as a limitation affecting transparency.

3.2 Information Sources and Search Strategy

The data for this study were obtained from electronic academic databases to ensure access to high-quality and peer-reviewed literature. A systematic search was conducted across five major databases, namely Google Scholar, Scopus, ERIC, Web of Science, and SpringerLink. These databases were selected for their interdisciplinary coverage of education, applied linguistics, and technology-enhanced learning, thereby ensuring comprehensive retrieval of relevant studies.

The final search was conducted on 6 March 2026. The search strategy was structured around three core conceptual domains, generative AI, self-regulated learning, and educational context, which were combined using Boolean operators (AND and OR). The generative AI domain included terms such as “generative AI,” “ChatGPT,” “large language model,” and “AI writing assistant,” alongside specific tools such as “Gemini,” “Bard,” and “Grammarly.” The SRL domain incorporated terms such as “self-regulated learning,” “SRL,” “Zimmerman model,” “forethought,” “performance,” and “self-reflection,” as well as metacognitive processes including planning, monitoring, and evaluation. The contextual domain focused on “ESL,” “EFL,” “academic writing,” “university students,” and “higher education.”

The search was limited to peer-reviewed journal articles and conference papers published between 2021 and March 2026. Only studies published in English were included. Duplicate records were removed using Mendeley reference management software and verified manually to ensure accuracy.

3.3 Screening and Selection Process

The study selection process followed the four phases outlined in the PRISMA 2020 framework: identification, screening, eligibility, and inclusion. In the identification phase, 73 records were retrieved across the five databases. After removing 5 duplicates (Google Scholar = 2, ERIC = 1, SpringerLink = 2), 68 unique records remained for screening.

During the title and abstract screening phase, all 68 records were assessed for relevance to the review focus. Records that clearly did not meet the inclusion criteria were excluded at this stage.

The remaining records then proceeded to the full-text eligibility phase, where each article was examined in detail against the predefined criteria. At this stage, 27 full-text articles were excluded for the following reasons:

- Non-generative AI tools (n = 7)
- No measurable SRL construct (n = 10)
- Non-university population (n = 5)
- Non-writing focus (n = 5)

Ultimately, 41 studies met all inclusion criteria and were retained for the final synthesis. The complete selection process is illustrated in Figure 1.

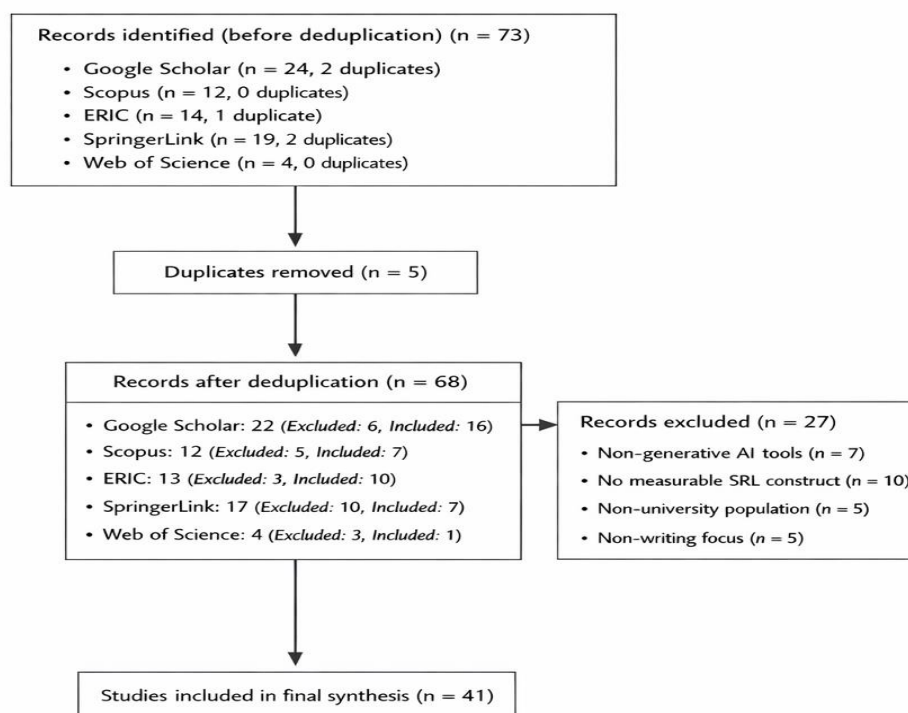


Figure 1. PRISMA 2020 Flow Diagram of Study Selection

3.4 Eligibility Criteria

The selection of studies was guided by defined inclusion and exclusion criteria to ensure consistency, relevance, and methodological rigour. The inclusion criteria focused on identifying studies that directly addressed the intersection of generative AI, self-regulated learning, and ESL/EFL academic writing in higher education contexts. Specifically, only empirical studies employing quantitative, qualitative, or

mixed-methods designs were considered. In addition, studies were required to involve ESL/EFL university students, utilise generative AI writing assistants, and examine SRL constructs aligned with Zimmerman's model. A summary of the inclusion criteria applied in this study is presented in Table 1, which outlines the key conditions that studies were required to meet to be considered eligible for inclusion in the study.

Table 1. Inclusion Criteria

Criterion	Description
Study type	Empirical studies (quantitative, qualitative, or mixed-methods)
Participants	ESL/EFL university or higher education students
Focus	Use of generative AI writing assistants (LLM-based tools)

SRL component	Examination of SRL or related constructs (e.g., planning, monitoring, evaluation, reflection)
Context	Academic writing in higher education
Publication	Peer-reviewed articles and conference papers
Timeframe	Published between January 2021 and March 2026
Language	English

In contrast, studies were excluded if they did not align with the core focus of the review. This included studies that examined non-generative AI tools ($n = 7$), lacked a measurable SRL construct ($n = 10$), involved a non-university population

($n = 5$), or focused on non-writing contexts ($n = 5$). Studies published outside the specified timeframe or in languages other than English were also excluded.

Table 2. Exclusion Criteria

Criterion	Description
AI type	Use of non-generative AI tools
SRL focus	Absence of SRL-related constructs or outcomes
Participants	Non-university or non-higher education populations
Context	Non-academic writing contexts
Study type	Non-empirical studies (reviews, editorials, conceptual papers)
Timeframe	Published before 2021
Language	Non-English publications

3.5 Data Extraction

Following the selection of studies, a structured data extraction process was conducted to capture relevant information systematically. A standardised data extraction form was developed and piloted to ensure consistency across all included studies. Extracted data included study context, research design, sample characteristics, types of generative AI tools used, SRL phases or constructs examined, pedagogical strategies, and key findings related to SRL and academic writing outcomes.

The reviewer conducted the data extraction process and independently verified a subset of studies to ensure reliability and minimise potential bias.

3.6 Quality Assessment

The methodological quality of the included studies was assessed using criteria adapted from the Joanna Briggs Institute critical appraisal tools (Aromataris & Munn, 2020). The assessment focused on evaluating the validity of SRL measurement, transparency in AI implementation, appropriateness of the research design, and clarity of data analysis procedures.

Studies were classified as having low or moderate risk of bias. No studies were excluded based on quality; instead, the assessment informed the interpretation of findings in the synthesis.

3.7 Data Synthesis

Due to the methodological heterogeneity of the included studies, a narrative synthesis approach was adopted (Popay et al., 2006). Quantitative findings were summarised descriptively, while qualitative data were analysed using thematic analysis as outlined by Braun and Clarke (2006).

The synthesis was structured around key analytical dimensions, including Zimmerman's SRL phases (forethought, performance, and self-reflection), metacognitive regulation processes, and pedagogical conditions influencing AI-supported learning. Both enabling and constraining effects of generative AI were examined to provide a balanced interpretation of the findings.

3.8 Limitations of the Review

Several limitations should be acknowledged. Screening and data extraction were primarily conducted by a single reviewer, although partial verification was undertaken to enhance reliability. The restriction to English-language publications may introduce language bias and limit the representation of diverse contexts. Furthermore, the heterogeneity of the included studies precluded meta-analysis, necessitating reliance on narrative synthesis.

4. RESULTS

4.1 Overview of Included Studies

The 41 studies included in this review collectively reflect a rapidly expanding yet regionally concentrated body of research on generative AI and self-regulated learning (SRL) in ESL/EFL academic writing. A dominant geographic pattern is evident, with 73.2% of studies conducted in Asian higher education contexts, particularly China, Indonesia, Turkey, Iran, Japan, South Korea, Thailand, and Vietnam (e.g., Chen & Alibakhshi, 2026; Hao & Razali, 2026; Jin et al., 2025; Teng, 2025; Yang et al., 2025; Nguyen et al., 2024; Irgatoglu et al., 2025; Mujeeb et al., 2026). This clustering suggests that institutional uptake of generative AI in these regions has been both rapid and systematically investigated. By contrast, only a small number of studies originate from outside these contexts (e.g., Morocco, Cyprus, Pakistan), and no study in the dataset is situated in Sub-Saharan Africa. From an African research perspective, this absence is not trivial: it signals a structural gap in the literature, given the continent's multilingual ecologies, diverse higher education systems, and uneven digital infrastructures, all of which may significantly mediate AI-supported SRL.

Methodologically, the field is characterised by a predominance of mixed-methods designs (46.3%), followed by qualitative studies (29.3%) and quasi-experimental approaches (19.5%), with only a small number of cross-sectional or instrument validation studies (e.g., Jin et al., 2025; Teng, 2025). This distribution indicates that the field remains exploratory, with many studies seeking to understand learner experience alongside measured outcomes. Mixed-methods studies such as Chen and Alibakhshi (2026), Hao and Razali (2026), and Mujeeb et al. (2026) combine intervention data with reflective or interview-based insights, while qualitative studies (e.g., Nguyen et al., 2024; Mahapatra, 2024; Nguyen & Doan, 2025) foreground learner, AI interaction and meaning-making processes. However, across these designs, there is a persistent reliance on self-report instruments such as the MSLQ and adapted SILL (Jin et al., 2025; Teng, 2025; Hao & Razali, 2026), raising concerns about whether reported SRL gains reflect actual regulatory behaviour or learners' perceptions of their engagement.

In terms of technological focus, ChatGPT and related interfaces (GPT-3.5, GPT-4, Poe) dominate the empirical landscape, appearing in 36 of the 41 studies (e.g., Chen & Alibakhshi, 2026; Tekir, 2026; Yang et al., 2025; Trinovita et al., 2025; El Hosayny et al., 2025). Other tools, including DeepSeek, Bard/Gemini, QuillBot, Grammarly, and Copilot are used less frequently and often in combination (e.g., Alexander & Savvidou, 2025; Jin et al., 2025; Hao & Razali, 2026). This concentration suggests that much of the current evidence base on "generative AI" is evidence about a narrow subset of LLM-

based tools, which may limit the generalisability of findings across platforms with different affordances.

4.2 Objective 1: Representation of SRL Across Zimmerman's Three Phases

4.2.1 Overall Phase Representation

Across the dataset, all three phases of Zimmerman's SRL model, forethought, performance, and self-reflection, are represented, but not equally. The performance phase dominates, appearing in 92.7% of studies, compared to 58.5% for forethought and 51.2% for self-reflection (e.g., Chen & Alibakhshi, 2026; Jin et al., 2025; Teng, 2025; Nguyen et al., 2024; Mahapatra, 2024; Yang et al., 2025). Only 15 studies (36.6%) operationalise all three phases within a single design (e.g., Hao & Razali, 2026; Tekir, 2026; Mujeeb et al., 2026), indicating that most research captures SRL only partially rather than as a cyclical process.

This distribution suggests that researchers tend to privilege aspects of SRL that are observable during task execution, particularly those embedded in learner-AI interaction. While no individual study explicitly tests this assumption, the consistency of this pattern across diverse methodologies (e.g., experimental, qualitative, mixed-methods) indicates a broader epistemological tendency within the field. Importantly, this imbalance is evident across both low- and moderate-risk-of-bias studies (e.g., Chen & Alibakhshi, 2026; Tekir, 2026; Trinovita et al., 2025), suggesting that it reflects a genuine research emphasis rather than a methodological limitation of weaker studies.

4.2.2 Measurement of SRL by Phase

The forethought phase is most commonly operationalised through self-report measures of goal setting, planning, and self-efficacy (e.g., Hao & Razali, 2026; Diasti & Murniati, 2026; Teng, 2025). These studies typically report moderate to high levels of planning behaviour, often using Likert-scale instruments. However, only a limited number of studies employ real-time or process-oriented methods, such as think-aloud protocols or trace data, to capture forethought as it unfolds (e.g., Yang et al., 2025). This reliance on retrospective reporting suggests that forethought may be overestimated, as learners reconstruct rather than directly report their planning processes.

By contrast, the performance phase is measured using a wider range of instruments and methods. Quantitative studies (e.g., Chen & Alibakhshi, 2026; Jin et al., 2025; Mujeeb et al., 2026) report statistically significant

improvements in cognitive and metacognitive strategies, often using adapted SILL or MSLQ scales. Process-oriented studies (e.g., Yang et al., 2025) analyse interaction patterns between learners and AI tools, identifying behaviours such as iterative drafting, re-reading, and prompt refinement. Qualitative evidence (Nguyen et al., 2024; Mahapatra, 2024; El Hosayny et al., 2025) further illustrates how learners engage in ongoing monitoring and adjustment during writing tasks. However, only a small subset of studies employs direct behavioural measures such as screen recordings or log data, limiting the strength of claims about actual regulatory activity.

The self-reflection phase is the least consistently measured. Most studies rely on reflective journals or post-task questionnaires (e.g., Nguyen et al., 2024; Chen & Alibakhshi, 2026; Mahapatra, 2024), which capture learners' perceptions of their performance rather than sustained reflective development. Quantitative findings from Trinovita et al. (2025) indicate lower engagement with reflection compared to planning, while Tekir (2026) is the only study to employ delayed post-testing to examine the persistence of reflective gains. Taken together, these findings suggest that reflection is both under-measured and temporally constrained within the current evidence base.

4.2.3 Contextual and Temporal Patterns

No consistent differences in SRL phase representation are observed across geographic regions or educational levels (e.g., undergraduate vs. postgraduate) (e.g., Hao & Razali, 2026; Mujeeb et al., 2026; Nguyen et al., 2024). However, a temporal pattern is evident: studies with longer intervention durations (e.g., Chen & Alibakhshi, 2026; Tekir, 2026; Irgatoğlu et al., 2025) are more likely to capture reflective processes than short-term interventions (e.g., Diasti & Murniati, 2026; Nguyen et al., 2024). This suggests that higher-order SRL processes such as reflection may require sustained engagement with AI-supported tasks to become empirically visible.

4.3 Objective 2: Metacognitive Regulation – Support, Hindrance, and Conditional Effects

4.3.1 Direction of Effects

The evidence base presents a predominantly supportive but nuanced picture of the relationship between generative AI and metacognitive regulation. A majority of studies report positive effects (e.g., Chen & Alibakhshi, 2026; Hao & Razali, 2026; Teng, 2025; Jin et al., 2025; El Hosayny et al., 2025), while a smaller number report mixed or conditional effects (e.g., Tekir, 2026; Trinovita et al., 2025; Amani & Bisriyah, 2025) and a minority report negative effects (e.g., Shi et al., 2025). Importantly, studies rated as low risk of bias are more likely

to report nuanced or conditional findings than uniformly positive ones, suggesting that methodological rigour reveals greater complexity in how AI interacts with SRL processes.

4.3.2 Mechanisms of Support

Across studies, several mechanisms explain how generative AI supports metacognitive regulation. Learners use AI tools to monitor their writing, identify weaknesses, and iteratively revise their work (Chen & Alibakhshi, 2026; El Hosayny et al., 2025; Nguyen et al., 2024; Mahapatra, 2024). Quantitative evidence reinforces this pattern: Hao and Razali (2026) report large effects on self-evaluation ($d = 0.84$), while Chen and Alibakhshi (2026) report significant gains in metacognitive strategies (partial $\eta^2 = 0.19$). Similarly, Jin et al. (2025) find that SRL strategies strongly predict higher-order AI use, particularly transformation-level engagement ($\beta = 0.71, p < .001$). Qualitative findings further illuminate these mechanisms. Learners frequently describe AI as a tool for “checking,” “verifying,” and “refining” their ideas (Nguyen et al., 2024; Mahapatra, 2024), indicating active engagement in evaluation and monitoring processes. These findings suggest that AI functions most effectively as a metacognitive scaffold when learners critically engage with its outputs.

4.3.3 Hindering Mechanisms

Despite these benefits, several studies identify risks associated with AI use. Shi et al. (2025) report that frequent AI users demonstrate lower levels of writing self-concept, while Tekir (2026) finds that high-frequency users produce less original and less analytically developed texts. Trinovita et al. (2025) further report weak associations between AI use and reflective depth ($r = 0.25$), suggesting limited engagement with higher-order SRL processes.

These findings indicate that generative AI can facilitate cognitive offloading, where learners rely on the tool rather than actively regulating their learning. This distinction between supported regulation and outsourced cognition emerges consistently across both quantitative and qualitative evidence (e.g., Tekir, 2026; Shi et al., 2025; Trinovita et al., 2025).

4.3.4 Conditional Effects

The impact of generative AI is not uniform but contingent on learner characteristics and instructional context. Studies consistently show that selective or strategic users benefit more than frequent but uncritical users (Tekir, 2026; Amani & Bisriyah, 2025). Similarly, learners with stronger pre-existing SRL skills are more likely to engage

with AI at deeper levels (Jin et al., 2025; Mujeeb et al., 2026). These findings suggest that generative AI amplifies existing regulatory capacities rather than independently developing them.

4.4 Objective 3: Pedagogical Strategies and Their Outcomes

Pedagogical design emerges as a central determinant of SRL outcomes. Studies incorporating AI literacy training (Chen & Alibakhshi, 2026; Alexander & Savvidou, 2025; Hao & Razali, 2026) consistently report higher levels of metacognitive awareness and more critical engagement with AI outputs. Structured feedback workflows (e.g., Jin et al., 2025; Mujeeb et al., 2026) are associated with the largest effect sizes, indicating that sequencing and scaffolding of AI use are critical.

Teacher mediation further strengthens these outcomes. Studies in which instructors explicitly model SRL strategies (e.g., Tekir, 2026; Irgatoğlu et al., 2025; El Hosayny et al., 2025) report greater transfer of regulatory skills to independent writing tasks. In contrast, studies involving unguided use (e.g., Trinovita et al., 2025; Diasti & Murniati, 2026; Fajaryani et al., 2025) consistently report surface-level engagement and weaker SRL outcomes.

These patterns suggest a hierarchy of effectiveness: structured and mediated approaches yield stronger outcomes, while unguided use carries greater risks of superficial engagement and cognitive offloading.

4.5 Synthesis of Contradictions

The contradictions observed across studies reflect the complexity of AI-supported learning rather than inconsistencies in the evidence. The tension between enhancement and externalisation of metacognitive regulation is evident across studies comparing structured and unstructured use (e.g., Chen & Alibakhshi, 2026; Jin et al., 2025 vs. Trinovita et al., 2025; Shi et al., 2025). Similarly, the dominance of the performance phase reflects methodological emphasis rather than theoretical completeness (e.g., Teng, 2025; Yang et al., 2025).

Further tension arises between quantitative and qualitative evidence. Studies reporting large effect sizes (e.g., Jin et al., 2025; Mujeeb et al., 2026) rely primarily on self-report measures, whereas process-oriented studies (e.g., Yang et al., 2025; Nguyen et al., 2024) provide more nuanced insights into learner behaviour. This divergence suggests that the magnitude of AI's impact on SRL remains difficult to establish conclusively.

Finally, the geographic concentration of studies limits generalisability. The absence of African contexts, in particular, raises important questions about how infrastructural constraints, linguistic diversity, and pedagogical traditions

may shape AI-supported SRL differently from the contexts currently represented in the literature.

4.6 Key Outcomes

Overall, the findings indicate that generative AI can support SRL in ESL/EFL academic writing, particularly in the performance phase. However, this support is conditional rather than universal. It depends on learner characteristics, duration of engagement, and, critically, pedagogical design. While most studies report supportive effects, a substantial minority identify risks related to cognitive offloading and reduced critical engagement. The evidence therefore, suggests that generative AI is most effective when embedded within structured, mediated, and pedagogically intentional learning environments.

5. DISCUSSION

This review examined how generative AI writing assistants influence self-regulated learning (SRL) in ESL/EFL university students' academic writing. By integrating the findings with prior scholarship, the discussion demonstrates that while existing literature provides important conceptual claims about AI and SRL, the empirical evidence both supports and complicates these assumptions, particularly when interpreted through Zimmerman's (2000) SRL model and metacognitive regulation theory.

A central point of convergence between the literature and the findings lies in the selective operationalisation of SRL. As highlighted in the literature review (de Mooij et al., 2025; Molenaar et al., 2023; Lan & Zhou, 2025), prior research tends to privilege the performance phase while neglecting forethought and self-reflection. The present findings empirically confirm this pattern. Most studies focus on monitoring, strategy use, and interaction with AI during writing, with far fewer examining planning or reflective processes. This alignment suggests that SRL has often been adopted as a partial framework, applied primarily where learner-AI interaction is observable. However, the findings extend the literature by showing that this imbalance is not merely conceptual but systematically embedded in research design, reinforcing a view of SRL that is reactive rather than cyclical. In Zimmerman's terms, the regulatory loop is truncated, limiting opportunities for learners to internalise strategies across phases.

The findings also provide a more nuanced perspective on the debate surrounding metacognitive regulation, which the literature positions as the central mechanism through which AI influences learning (Schraw & Dennison, 1994, as cited in Banihashem et al., 2025; Lan & Zhou, 2025).

Consistent with studies emphasising AI's affordances (Nguyen et al., 2024; Nikolopoulou, 2024), the results show that learners frequently engage in monitoring and evaluation when interacting with AI, using it to identify weaknesses, refine arguments, and generate alternatives. This supports the claim that AI can function as a metacognitive scaffold, extending learners' capacity to regulate their writing.

However, the findings also substantiate the counter-argument in the literature that AI may lead to externalisation of metacognitive processes (Kanont et al., 2024; Lan & Zhou, 2025). Evidence of cognitive offloading, uncritical acceptance of AI outputs, and reduced monitoring effort indicates that metacognitive activity may be performed but not internalised. This extends prior critiques by demonstrating that the tension between enhancement and externalisation is not theoretical but empirically observable across multiple studies. In this sense, the findings refine the literature by introducing a critical distinction between metacognitive engagement as behaviour and metacognitive development as competence, a distinction that has remained largely implicit in previous work.

The review further advances the literature on generative AI as a pedagogical tool, which has been characterised by competing assumptions of empowerment and dependency (Nikolopoulou, 2024; Tekir, 2026). The findings suggest that both perspectives are valid, but incomplete when considered in isolation. Rather than being inherent properties of AI, supportive and hindering effects are shown to be contingent on pedagogical conditions, a point that aligns with but also extends earlier calls for more attention to instructional design (Lan & Zhou, 2025). Studies incorporating structured interventions, such as AI literacy training, guided workflows, and teacher mediation, demonstrate stronger SRL outcomes, whereas unguided use is associated with surface-level engagement. This reinforces the argument that AI should not be conceptualised as an independent variable, but as a pedagogically mediated artefact whose impact depends on how it is embedded within learning environments.

Importantly, the findings also speak directly to the methodological limitations identified in the literature review (Banihashem et al., 2025; de Mooij et al., 2025; Xu et al., 2026). The dominance of self-report measures and short-term designs is confirmed, raising concerns about the validity of claims regarding SRL development. While many studies report improvements in strategy use or writing performance, the evidence suggests that these gains may reflect situated task support rather than durable competence, reinforcing the performance-competence divide highlighted in prior research. The limited use of process-oriented methods further constrains the field's ability to capture SRL as a dynamic and evolving process.

The findings deepen the literature's critique of contextual and geographic concentration (Chung & Wan, 2025; Zhang et al.,

2025). The strong clustering of studies in Asian higher education contexts is not only confirmed but also shown to shape the evidence base itself, limiting the generalisability of conclusions. Notably, the absence of studies from African contexts is particularly significant, given the region's linguistic diversity and differing levels of digital infrastructure. This suggests that current understandings of AI-supported SRL may reflect context-specific dynamics rather than universal patterns, an issue acknowledged in the literature but insufficiently addressed empirically.

The discussion demonstrates that the findings both validate and extend existing scholarship. While prior research correctly identifies the potential of generative AI to support SRL, it underestimates the extent to which this support is uneven, context-dependent, and pedagogically mediated. By explicitly linking empirical patterns to SRL theory and metacognitive regulation, this review provides a more coherent account of how AI reshapes, not simply enhances, self-regulated learning in academic writing.

6. CONCLUSION

This systematic review examined how generative AI writing assistants influence self-regulated learning (SRL) in ESL/EFL university students' academic writing. Guided by Zimmerman's (2000) three-phase SRL model and metacognitive regulation theory, the study provides a theoretically grounded synthesis of a rapidly expanding but fragmented body of research. The conclusions drawn here directly address the study's objectives and clarify the conditions under which generative AI supports or constrains self-regulated learning.

In line with the first objective, the review concludes that SRL is unevenly represented across its three phases in the existing literature. While the performance phase, particularly monitoring and strategy use, is extensively examined, the forethought (goal setting, planning) and self-reflection (evaluation, adaptation) phases remain comparatively underdeveloped. This imbalance confirms concerns raised in the literature that SRL is often operationalised selectively rather than holistically. The study therefore concludes that current research does not fully capture SRL as a cyclical process, but rather reflects a performance-oriented model of regulation, shaped by the observable nature of learner-AI interaction.

Regarding the second objective, the review finds that generative AI has a dual and context-dependent impact on metacognitive regulation. On one hand, AI supports monitoring, evaluation, and iterative revision by providing immediate and accessible feedback, thereby enhancing learners' engagement with their writing processes. On the other hand, there is consistent evidence of cognitive

offloading, uncritical acceptance of AI outputs, and reduced regulatory effort, indicating that metacognitive processes may be partially externalised to the tool. The study, therefore, concludes that generative AI does not inherently develop metacognitive regulation; rather, it creates conditions under which regulation may be either strengthened or displaced, depending on how learners engage with the technology.

Regarding the third objective, the review demonstrates that pedagogical design is the decisive factor in shaping SRL outcomes. Studies that integrate AI through structured approaches, such as AI literacy training, guided feedback workflows, and teacher mediation, are consistently associated with more balanced engagement across SRL phases and stronger metacognitive regulation. In contrast, unguided use tends to reinforce surface-level interaction and dependency on AI. The study, therefore, concludes that generative AI functions most effectively not as an autonomous learning tool, but as a pedagogically mediated resource embedded within SRL-informed instructional practices.

These findings demonstrate that generative AI reshapes, rather than simply enhances, self-regulated learning in academic writing. Its influence is not inherently beneficial or detrimental but is contingent on the interaction among learner characteristics, task design, and instructional support. While AI can extend learners' regulatory capacity, it may also undermine the internalisation of SRL processes if used without critical engagement.

The study also concludes that the current evidence base remains methodologically and contextually limited, with a heavy reliance on self-report measures, short-term designs, and geographically concentrated samples. As a result, claims about the long-term development of SRL in AI-supported contexts should be interpreted with caution.

In sum, generative AI holds considerable promise for supporting ESL/EFL academic writing, but only when its use is explicitly aligned with the principles of self-regulated learning. Without such alignment, there is a risk that AI may optimise writing performance while weakening the very regulatory competencies that underpin independent academic development.

7. RECOMMENDATIONS

Generative AI integration in ESL/EFL academic writing should be explicitly aligned with Zimmerman's three SRL phases, forethought, performance, and self-reflection, to support the full regulatory cycle rather than fragmented engagement. AI literacy training should be embedded, focusing on prompt design, critical verification, and ethical use, to mitigate cognitive offloading and the risk of uncritical reliance. Crucially, AI should be positioned as a scaffold rather than a substitute, with sustained teacher mediation through strategy modelling, guided interaction, and structured reflection.

Assessment practices should be reoriented toward process-based evidence (e.g., revision histories, metacognitive commentaries) alongside final products to support the development of genuine regulatory competence rather than AI-assisted performance.

Future research should prioritise longitudinal designs that track the development of SRL over time, addressing the current dominance of short-term studies that blur the distinction between immediate performance gains and durable learning (the performance–competence divide). Greater use of process-oriented methodologies, such as trace data, interaction logs, and screen recordings, is needed to capture enacted regulation beyond self-report measures. Theoretical rigour should be strengthened by systematically operationalising all SRL phases and explicitly distinguishing between metacognitive support and the externalisation of regulation. Finally, the evidence base should be expanded to underrepresented contexts, particularly African and linguistically diverse settings, to improve the global validity of AI–SRL research.

At an institutional level, clear guidelines are needed to frame generative AI as a pedagogical tool aligned with SRL principles rather than a replacement for learner cognition. Policies should balance innovation with academic integrity by promoting responsible AI use while fostering learner autonomy, critical engagement, and sustained development of self-regulated academic writing skills.

REFERENCES

1. Alexander, K. and Savvidou, C. (2025) 'Reflecting on Chappelle's view of open GenAI's role in language education: Using ChatGPT for academic writing courses in higher education', *Language Teaching Research Quarterly*, 51, pp. 203–225. Available at: <https://doi.org/10.32038/ltrq.2025.51.02>.
2. Amani, N. and Bisriyah, M. (2025) 'University students' perceptions of AI-assisted writing tools in supporting self-regulated writing practices', *Indonesian Journal of English Language Teaching and Applied Linguistics*, 10(1). Available at: <https://doi.org/10.21093/ijeltal.v10i1.1942>.
3. Arif, H. and Naeem, J. (2025) 'The impact of generative AI on learner autonomy and critical thinking in English as a foreign language (EFL) writing classrooms', *Journal of Applied Linguistics and TESOL (JALT)*, 8(3), pp. 2269–2290.
4. Aromataris, E. and Munn, Z. (eds.) (2020) *JBIM manual for evidence synthesis*. Joanna Briggs Institute. Available at: <https://doi.org/10.46658/JBIMES-20-01>.
5. Banihashem, S.K., Bond, M., Bergdahl, N., Khosravi, H. and Noroozi, O. (2025) 'A systematic mapping

- review at the intersection of artificial intelligence and self-regulated learning: A call for increased theoretical grounding, focus on motivation and diversifying context', *International Journal of Educational Technology in Higher Education*, 22(50), pp. 1–46. Available at: <https://doi.org/10.1186/s41239-025-00548-8>.
6. Braun, V. and Clarke, V. (2006) 'Using thematic analysis in psychology', *Qualitative Research in Psychology*, 3(2), pp. 77–101. Available at: <https://doi.org/10.1191/1478088706qp0630a>.
 7. Chauhan, P. (2022) 'Fundamentals of academic writing: A literature review', *Journal of NELTA*, 27(1–2), pp. 161–170. Available at: <https://doi.org/10.3126/nelta.v27i1-2.53201>.
 8. Chen, J. and Alibakhshi, G. (2026) 'AI-powered applications' effects on English language learners' cognitive, metacognitive, and resource management strategies, and language achievement', *Computer Assisted Learning*. (In press; DOI not yet indexed).
 9. Chung, E. and Wan, A. (2025) 'Examining the use of academic vocabulary in first-year ESL undergraduates' writing: A corpus-driven study in Hong Kong', *Assessing Writing*, 63, p. 100913. Available at: <https://doi.org/10.1016/j.asw.2024.100913>.
 10. Conde Gafaro, B. (2022) 'Self-regulated learning in MOOCs: Goal setting and goal orientation', in Rienties, B., Hampel, R., Scanlon, E. and Whitelock, D. (eds.) *Open world learning: Research, innovation and the challenges of high-quality education*. Routledge, pp. 63–75.
 11. de Mooij, S., Lamsa, J., Lim, L., Aksela, O., Athavale, S., Bistolfi, I., Jin, F., Li, T., Azevedo, R., Bannert, M., Gašević, D., Järvelä, S. and Molenaar, I. (2025) 'A systematic review of self-regulated learning through integration of multimodal data and artificial intelligence', *Educational Psychology Review*, 37, p. 54. Available at: <https://doi.org/10.1007/s10648-025-10028-0>.
 12. Diasti, K.S. and Murniati, C.T. (2026) 'EFL students' self-regulation in the writing process using ChatGPT', *Journal of English Teaching, Literature, and Applied Linguistics*, 10(1), pp. 133–138. (DOI not yet indexed; journal forthcoming).
 13. EL Hosayny, O., Razkane, H. and Yeou, M. (2025) 'Metacognitive regulation and ChatGPT-assisted writing: Introducing an interactive model for cultivating strategic engagement', *Discover Education*, 4(1), pp. 1–23. Available at: <https://doi.org/10.1007/s44217-026-01282-7>.
 14. Fajaryani, N., et al. (2025) 'Navigating the use of AI in academic writing: Challenges and strategies for EFL students', *EDUTICON Conference Proceedings*. (DOI not available).
 15. Hao, H. and Razali, A.B. (2026) 'Impact of AI-assisted peer feedback on EFL students' self-regulated learning, self-efficacy, and motivation in English academic writing', *International Journal of Instruction*, 19(2). Available at: <https://doi.org/10.29333/iji.2026.1929a>.
 16. Hapsari, D. and Rizky, A. (2025) 'Indonesian EFL students' perception of AI applications to support SRL', *Atlantis Press, Advances in Social Science, Education and Humanities Research*. Available at: https://doi.org/10.2991/978-2-38476-394-8_46.
 17. Hsu, L. (2025) 'Entangled cognition in EFL education: The role of generative AI', *Contemporary Educational Technology*, 17(4), ep619. Available at: <https://doi.org/10.30935/cedtech/17621>.
 18. Huang, J. and Mizumoto, A. (2025) 'The effects of generative AI usage in EFL classrooms on the L2 motivational self system', *Education and Information Technologies*, 30, pp. 6435–6454. Available at: <https://doi.org/10.1007/s10639-024-12717-9>.
 19. Irgatoğlu, A., Selvi, A.E., Yurttadur, O. and Dağbaşı, G. (2025) 'Sustainable L2 writing pedagogy: Effects of AI-mediated feedback on SRL', *Preprints.org*. Available at: <https://doi.org/10.20944/preprints202601.2397.v1>.
 20. Jang, H., Jin, L. and So, H. (2026) 'Examining university students' engagement with ChatGPT in English essay writing: Interaction patterns and perceptions', *The Asia-Pacific Education Researcher*. Available at: <https://doi.org/10.1007/s40299-025-01076-9>.
 21. Jin, L., et al. (2025) 'ESL/EFL international postgraduates' SRL strategies in academic writing with ChatGPT', *Education Sciences*, 15(11), p. 1521. Available at: <https://doi.org/10.3390/educsci15111521>.
 22. Jin, S.-H., Im, K., Yoo, M., Roll, I. and Seo, K. (2023) 'Supporting students' self-regulated learning in online learning using artificial intelligence applications', *International Journal of Educational Technology in Higher Education*, 20(37). Available at: <https://doi.org/10.1186/s41239-023-00406-5>.
 23. Kanont, K., Pingmuang, P., Simasathien, T., Wisnuwong, S., Wiwatsiripong, B., Poonpirome, K., Songkram, N. and Khlaisang, J. (2024) 'Generative-AI, a learning assistant? Factors influencing higher-ed students' technology acceptance', *Electronic Journal of e-Learning*, 22(6), pp. 18–33. Available at: <https://doi.org/10.34190/ejel.22.6.3196>.
 24. Ky, M. and Lian, A. (2025) 'A comparative analysis of academic literacy support models: Impacts on SRL

- for international students', *Australasian Journal of Educational Technology*, 41(5). Available at: <https://doi.org/10.14742/ajet.10486>.
25. Lan, M. and Zhou, X. (2025) 'A qualitative systematic review on AI-empowered self-regulated learning in higher education', *npj Science of Learning*, 10(21). Available at: <https://doi.org/10.1038/s41539-025-00319-0>.
 26. Luo, L. and Yusuf, A. (2025) 'Bridging AI and pedagogy: How AI-adaptive feedback shapes Chinese EFL students' writing engagement, metacognitive strategies, and performance', *Assessment & Evaluation in Higher Education*. Available at: <https://doi.org/10.1080/02602938.2025.2548919>.
 27. Mäkipää, T. and Tsagari, D. (2026) 'Feedback and self-regulation in L2 writing: A research timeline of formative assessment', *Language Teaching*, 59(1), pp. 1–20.
 28. Mazari, N. (2025) 'Building metacognitive skills using AI tools to help higher education students reflect on their learning process', *RHS-Revista Humanismo y Sociedad*, 13(1), pp. 1–20. Available at: <https://doi.org/10.22209/rhs.v13n1a04>.
 29. McHugh, M.L. (2012) 'Interrater reliability: The kappa statistic', *Biochemia Medica*, 22(3), pp. 276–282. Available at: <https://doi.org/10.11613/BM.2012.031>.
 30. Molenaar, I., de Mooij, S., Azevedo, R., Bannert, M., Järvelä, S. and Gašević, D. (2023) 'Measuring self-regulated learning and the role of AI: Five years of research using multimodal multichannel data', *Computers in Human Behavior*, 139, p. 107540. Available at: <https://doi.org/10.1016/j.chb.2022.107540>.
 31. Mujeeb, N., Lodhi, M.A., Ali, A., Mashwani, W.K., Mostafa, S.M. and Ahmadini, A.A.H. (2026) 'Beyond red ink: AI feedback and ESL academic writing development in higher education', *Language Testing in Asia*, 16(1), p. 24. Available at: <https://doi.org/10.1186/s40468-026-00442-8>.
 32. Nguyen, A., Ilesanmi, F., Dang, B., Vuorenmaa, E. and Järvelä, S. (2024) 'Hybrid intelligence in academic writing: Examining self-regulated learning patterns in an AI-assisted writing task', *Frontiers in Artificial Intelligence and Applications*, 386, pp. 241–254. Available at: <https://doi.org/10.3233/FAIA240198>.
 33. Nguyen, Q.N. and Doan, D.T.H. (2025) 'ChatGPT's effects on EFL learners' autonomy and self-efficacy in self-regulated learning contexts', *JALT CALL Journal*, 21(2). Available at: <https://doi.org/10.29140/jaltcall.v21n2.102968>.
 34. Nguyen, T. (2025) 'Investigating writing self-efficacy and SRL strategies among ESL majors', *SAGE Open*. Available at: <https://doi.org/10.1177/21582440251406353>.
 35. Nikolopoulou, K. (2024) 'Generative artificial intelligence in higher education: Exploring ways of harnessing pedagogical practices with the assistance of ChatGPT', *International Journal of Changes in Education*, 1(2), pp. 103–111. Available at: <https://doi.org/10.47852/bonviewIJCE42022489>.
 36. Page, M.J., McKenzie, J.E., Bossuyt, P.M., Boutron, I., Hoffmann, T.C., Mulrow, C.D., Shamseer, L., Tetzlaff, J.M., Akl, E.A., Brennan, S.E., Chou, R., Glanville, J., Grimshaw, J.M., Hróbjartsson, A., Lalu, M.M., Li, T., Loder, E.W., Mayo-Wilson, E., McDonald, S., ... Moher, D. (2021) 'The PRISMA 2020 statement: An updated guideline for reporting systematic reviews', *BMJ*, 372, n71. Available at: <https://doi.org/10.1136/bmj.n71>.
 37. Popay, J., Roberts, H., Sowden, A., Petticrew, M., Arai, L., Rodgers, M., Britten, N., Roen, K. and Duffy, S. (2006) *Guidance on the conduct of narrative synthesis in systematic reviews*. ESRC Methods Programme. Available at: http://www.lancaster.ac.uk/shm/research/nssr/research/dissemination/publications/NS_Synthesis_Guidance_v1.pdf.
 38. Qazi, M.H., Munir, T., Zaigham, M.S. and Mughal, U.A. (2025) 'The impact of AI-assisted self-regulated learning, specifically ChatGPT, on students' engagement and writing skill enhancement', *Journal of Applied Linguistics and TESOL (JALT)*, 8(1), pp. 393–415.
 39. Rahnuma, N. (2025) 'Exploring ESL students' experiences of academic writing in higher education: A cultural historical activity theory perspective', *Education Inquiry*, 16(3), pp. 303–325. Available at: <https://doi.org/10.1080/20004508.2023.2222450>.
 40. Sagita, M., Sagita, E.S. and Syafari, N. (2025) 'The role of generative AI companions in promoting reading engagement and self-regulation in EFL contexts', *PES: Pendidikan English Scholar*, 4(3), pp. 448–465.
 41. Salmani Nodoushan, M.A. (2012) 'Self-regulated learning (SRL): Emergence of the RSRLM model', *International Journal of Language Studies*, 6(3), pp. 1–16.
 42. Selvadurai, V., Rodrigues, P. and Rajamohan, L. (2024) 'Engaging with AI: Exploring ChatGPT's role in self-regulation and pre-writing stage', *Proceedings of the VietTESOL International Convention 2024*, pp. 211–227.
 43. Shen, B. and Bai, B. (2024) 'Enhancing Chinese

- university students' writing performance and self-regulated learning (SRL) writing strategy use through a strategy-based intervention', *System*, 122, p. 103249. Available at: <https://doi.org/10.1016/j.system.2024.103249>.
44. Shi, H., Chai, C.S., Zhou, S. and Aubrey, S. (2025) 'Comparing the effects of ChatGPT and automated writing evaluation on students' writing and ideal L2 writing self', *Computer Assisted Language Learning*. Available at: <https://doi.org/10.1080/09588221.2025.2454541>.
 45. Sinkkonen, M. and Tapani, A. (2024) 'Review of the concept "Self-Regulated Learning": Defined and used in different educational contexts', *International Journal on Social and Education Sciences*, 6(1), pp. 130–151. Available at: <https://doi.org/10.46328/ijonses.640>.
 46. Stofiana, T., Sunendar, D., Mulyati, Y. and Sastromiharjo, A. (2025) 'Metacognition-based academic writing with generative-AI scaffolding: Student and instructor needs', *Journal of Educational Research and Evaluation*, 14(1), pp. 1–18.
 47. Tanharat, N. and Phootirat, P. (2025) 'Integrating generative AI in EFL academic writing: Thai English-major students' purposes, perceptions, and experiences with ChatGPT', *rEFLECTIONS*, 32(3), pp. 188–211.
 48. Tekir, S. (2026) 'Generative AI use in EFL writing: Associations with originality, critical reasoning, and metacognitive engagement in a Turkish higher education context', *Computer Assisted Language Learning*, pp. 1–23. Available at: <https://doi.org/10.1080/09588221.2026.2617399>.
 49. Teng, M.F. (2025) 'Metacognitive awareness and EFL learners' perceptions and experiences in utilising ChatGPT for writing feedback', *European Journal of Education*, 60(1), e12811. Available at: <https://doi.org/10.1111/ejed.12811>.
 50. Torsani, S. (2025) 'Developing self-regulation for generative AI through a metacognitive checklist: A case study of an in-service language teacher', *Australian Journal of Applied Linguistics*, 8(4), pp. 1–20.
 51. Trinovita, D., Nurchurifiani, E., Hastomo, T., Andewi, W. and Hasbi, M. (2025) 'Exploring the influence of generative AI on self-regulated learning: A mixed-methods study in the EFL context', *Jurnal Iqra': Kajian Ilmu Pendidikan*, 10(2). Available at: <https://doi.org/10.25217/ji.v10i2.6389>.
 52. Van Horn, K.R. (2024) 'ChatGPT in English language learning: Exploring perceptions and promoting autonomy in a university EFL context', *TESL-EJ*, 28(1). Available at: <https://doi.org/10.55593/ej.28109a8>.
 53. Wang, Y. (2024) 'Cognitive and sociocultural dynamics of self-regulated use of machine translation and generative AI tools in academic EFL writing', *System*, 126, p. 103505. Available at: <https://doi.org/10.1016/j.system.2024.103505>.
 54. Wu, X.-Y., Ng, D.T.K. and Chiu, T.K.F. (2026) 'Self-regulated learning with AI: A comparative analysis of general-purpose and task-specific platforms', *International Journal of Technology in Education*, 9(1), pp. 279–302.
 55. Xu, J., Luo, Y., Wang, C., Wang, M. and Wu, Y. (2026) 'AI support in self-regulated learning: A decade of technological evolution and meta-analysis', *British Journal of Educational Technology*, 57(1), pp. 1–30. Available at: <https://doi.org/10.1111/bjet.70058>.
 56. Yang, K., Raković, M., Fan, Y., Tang, L., Li, X. and Gašević, D. (2025) 'Beyond self-regulated learning processes: Hidden tactics in generative AI-assisted writing', *arXiv*. Available at: <https://doi.org/10.48550/arXiv.2501.12345>.
 57. Zimmerman, B. J. (2000). Attaining self-regulation: A social cognitive perspective. In M. Boekaerts, P. R. Pintrich, & M. Zeidner (Eds.), *Handbook of self-regulation* (pp. 13–39). Academic Press. <https://doi.org/10.1016/B978-012109890-2/50031-7>
 58. Zhang, Z., Zhou, S. and Bai, B. (2025) 'A systematic scoping review of self-regulated learning with AI in language education', *International Journal of Applied Linguistics*, pp. 1–14. Available at: <https://doi.org/10.1111/ijal.70030>.